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Positional Asphyxiation in Adults

A Series of 30 Cases from the Dade and Broward County Florida Medical Examiner Offices from 1982 to 1990

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Over a 9-year period, 30 cases of positional (or postural) asphyxia were identified in the Dade and Broward County (Florida) Medical Examiner Offices. The victims had an average age of 50.6 years with no significant sex or racial differences as compared with the general medical examiner population. Chronic alcoholism or acute alcohol intoxication was a significant risk factor in 75% of cases and these had an average postmortem ethanol concentration of 0.24 g%. Signs of mechanical asphyxiation (petechiae and/or combined lung weights >900 g) were present in 93% of cases. Victims were commonly (43%) found in a restrictive position producing hyperflexion of the head and neck. Two deaths involved restraint vests ("poseys") in elderly, demented, wheelchair-confined victims. Scene photographs of the undisturbed decedent are extremely helpful in confirming a suspicion of postional asphyxia.

Key Words: Accident—Acute alcohol intoxication—Chronic alcoholism—Positional asphyxiation—Postural asphyxiation—Death-scene investigation.

When a person's bodily position results in partial or complete airway obstruction, death may occur from asphyxiation. Although this phenomenon of positional (or postural) asphyxia seems obvious and is well known to forensic pathologists, the subject is hardly mentioned in current forensic textbooks (1,2) or journal articles (3,4). To our knowledge, only one case has been reported in detail (5). This study was therefore undertaken to elucidate the phenomenon of positional asphyxia and delineate its predisposing factors.

MATERIALS AND METHODS

The Broward and Dade County Florida Medical Examiner Offices are responsible for determining the cause and manner of death in all cases where the death is sudden and unexpected, or where the cause of death is suspected of being other than natural. The death investigation includes police and witness reports, medical and social history, autopsy, and toxicologic analysis where indicated (6). The geographic jurisdictions encompass the greater Fort Lauderdale and Miami, Florida, areas, with a population base of ~3 million people.

All deaths categorized as resulting from accidental asphyxia that had been autopsied by the medical examiner from January 1982 through December 1990 (9 years) were reviewed to detect cases of positional asphyxia. During this time, the medical examiner offices had completed ~4,500 autopsies of persons who had died of nonvehicular accidents. Of these, 6% (270 cases) were asphyxial deaths. Accidental asphyxial deaths that fulfilled the following criteria were considered as positional asphyxia:

1. The person is discovered in a position that does not allow adequate breathing. Although this may involve a restrictive or confining po-

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TABLE 1. *Age distribution by decade*

Age (years)	Number
16–20	1
21–30	6
31–40	5
41–50	5
51–60	2
61–70	5
71–80	4
81–90	2

sition, it may also involve simple flexion of the head onto the chest, a partial or complete external airway obstruction, or neck compression.

2. Scene and historical evidence indicate that the decedent placed himself or herself in that position inadvertently and without the deliberate action of another person.
3. The person could not extricate himself or herself from the fatal position (for example, because of chemical intoxication or dementia).
4. There is no evidence of internal airway obstruction (for instance, fatal food aspiration).
5. There is no evidence of carbon monoxide or other suffocating gases.
6. There is no evidence of significant cardiac disease.

The 30 cases identified were evaluated for age, sex, race, location of the body, the position in which the body was found, risk factors, lung weights, presence and location of petechiae, toxicologic results (including blood alcohol concentration), and any other significant abnormality that may have contributed to the death. Scene photographs taken by either the medical examiner or police were examined in 13 of the 30 cases.

RESULTS

The mean age of decedents was 50.6 years and the age distribution by decade is presented in Table 1. The male–female ratio was 2:1, which does not differ significantly from the male–female ratio of all medical examiner cases. Of the 30 victims, 24 were white and the other six were black. The place of death was most frequently the bedroom (Table 2).

FIG. 1. This 16-year-old automobile driver struck a concrete utility pole and was thrown to the passenger side. The victim's head is hyperflexed against the front passenger door. Foamy blood-tinged pulmonary edema fluid pours out of the endotracheal tube.

The risk factors that prevented the decedents from extricating themselves from their fatal position are summarized in Table 3.

Alcohol use was a risk factor in 22 cases. Postmortem blood alcohol level was determined in 23 cases, with a mean level of 0.24%. The range was 0.01–0.48 and 17 decedents had levels of $\geq 0.10\%$. In the drug category, one decedent had levels of chlordiazepoxide (0.26 mg/L gastric), nordiazepam (0.40 mg/L gastric), nortriptyline (2 mg/L gastric), phenobarbital (trace urine), and amitriptyline (.56 mg/L blood). In the "other" category, one unlucky robber was found suspended from a fence by his shirt, while two other unfortunates were trapped within an overturned or damaged car (Fig. 1), but with no apparent fatal blunt-force injuries. In none of these was alcohol or drugs detected.

The mean combined lung weights available in all of these cases was 1,125 g, with a range of 770–

TABLE 2. *Location of the body*

Location	Number	Percent
Bedroom	11	36.7
Automobile	5	16.7
Living room	3	10.0
Bathroom	4	13.3
Outside/yard	3	10.0
Stairway	3	10.0
Other	1	3.3

TABLE 3. *Risk factors*

Risk factor	Number	Percent
Alcoholism	22	73.4
Degenerative brain disease	3	10.0
Other drugs	1	3.3
Other	4	13.3

FIG. 2. This 29-year-old alcoholic fell asleep with his head and neck hyperflexed in the back seat of this automobile. His postmortem blood ethanol concentration was 0.39%.

2,110 g. Of the 30 decedents, 13 had petechiae (Table 4).

The position of the decedents varied in each case, thus making generalizations difficult. Photographs were not taken or the body was moved during resuscitation attempts in 17 of the 30 cases. In the absence of scene photographs, it was necessary to rely on the police or other investigator's observations, or on interviews with the person who first found the body. The position of the decedents when found is given in Table 5.

Thirteen victims were found in an "awkward" or restrictive position resulting in hyperflexion of the head and airway obstruction. Two such cases are depicted in Figs. 2 and 3. Seven decedents were found face down in a suffocating object (for example, in a pillow or in sand) (Fig. 4). Four victims were found sitting upright, but their heads were flexed and resting on their chests. One alcohol-intoxicated man was found dead on a commuter train with his hyperflexed head occluding his tracheostomy stoma (Fig. 5). Another inebriated victim, found sitting with her head flexed on her chest, also had a diffuse goiter that contributed to the airway obstruction (Fig. 6). Four decedents were found with either their upper torso hyperflexed (Fig. 7) or lying over an object (usually a bathtub) while vomiting (Fig. 8). Such positions prevent movement of the diaphragm and chest and may also compromise chest volume by forcing the viscera cephalad. The three oldest victims (ages 89, 89, and 79) had either senile dementia or Parkinson's disease. Both demented victims died because their wheelchairs overturned while they were in vest restraints. One fell down a flight of stairs (Fig. 9). The patient with Parkinson's disease was found trapped within a stairway railing, his age and infirmities preventing escape.

TABLE 4. *Location of petechiae*

Location	Number
Skin (various sites)	7
Conjunctiva	6
Epicardium	2
Muscle	2
Larynx/epiglottis	2

TABLE 5. *Position of body when found*

Position of body	Number	Percent
Restrictive position: hyperflexed neck, obstruction	13	43.3
Face down: nares and mouth obstruction	7	23.3
Lying over object: restricted diaphragm, chest movement	4	13.3
Sitting upright: neck hyperflexed	4	13.3
Vest restraints: tied in wheelchair, obstructed airway	2	6.8

DISCUSSION

The definition of postural or positional asphyxia involves three main criteria. First, the decedent must be found in a position that interferes with pulmonary gas exchange. This may range from covering the mouth and nares to restriction of the diaphragm and chest. Secondly, the ability of the person to escape this position must be explained. This is critical since it is known that the mechanical obstruction of the airways of dogs induces a variable period of forceful respirations and hyperactivity as the animal attempts to alleviate the anoxia (7). Thirdly, other causes of death, both natural and unnatural, must be excluded with a reasonable degree of certainty by a thorough autopsy.

We chose to exclude children from our study because their small size alone makes them more susceptible to asphyxial death and would be described as smothering, hanging, or traumatic asphyxiation. The age distribution of our cases reflects that of persons who die from complications of chronic alcoholism, except for a slight preponderance in the younger (21–30) age group. The three oldest victims all had degenerative brain disease as their risk

FIG. 3. This 60-year-old intoxicated alcoholic fell off her sofa into this restrictive position with her head and neck flexed against the wall.

factor. The male–female ratio is similar to that of all medical examiner cases and, therefore, a true male predominance probably does exist. There is, however, a slight predominance of white victims, since the white–black ratio of all medical examiner cases is ~3:1.

Acute alcohol intoxication is the major risk factor for positional asphyxiation. Its central nervous system depression causes relaxation of the muscles that keep the airway open during sleep, in particular the genioglossal muscle which draws the tongue forward during inspiration and prevents its lapse into the pharynx (8,9). The heart continues to beat for a variable period of time after the lungs stop moving and this may produce pulmonary edema, visceral congestion, and petechiae of the skin, conjunctivae, or viscera (10). Petechiae are not specific for asphyxial death (4) and may be seen in natural deaths involving cardiopulmonary resuscitation (11). While petechiae were seen in less than half of our cases, pulmonary edema or congestion (as manifested by increased lung weights) was almost invariably present.

The average postmortem blood alcohol concentration was 0.24%. All of those with blood alcohol concentrations between 0.01% and 0.03% had a history of alcohol abuse, the signs of which were usually evident at the scene. The low levels could

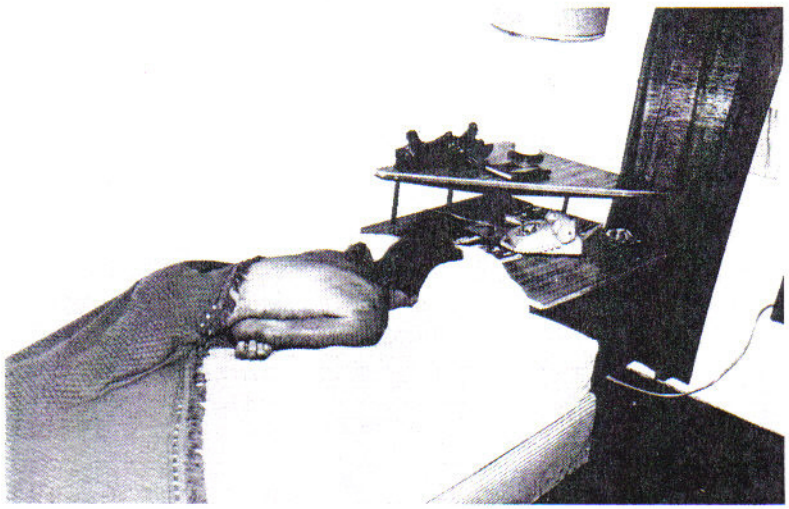

FIG. 4. This 30-year-old intoxicated alcoholic was found dead with his face buried in the pillow.

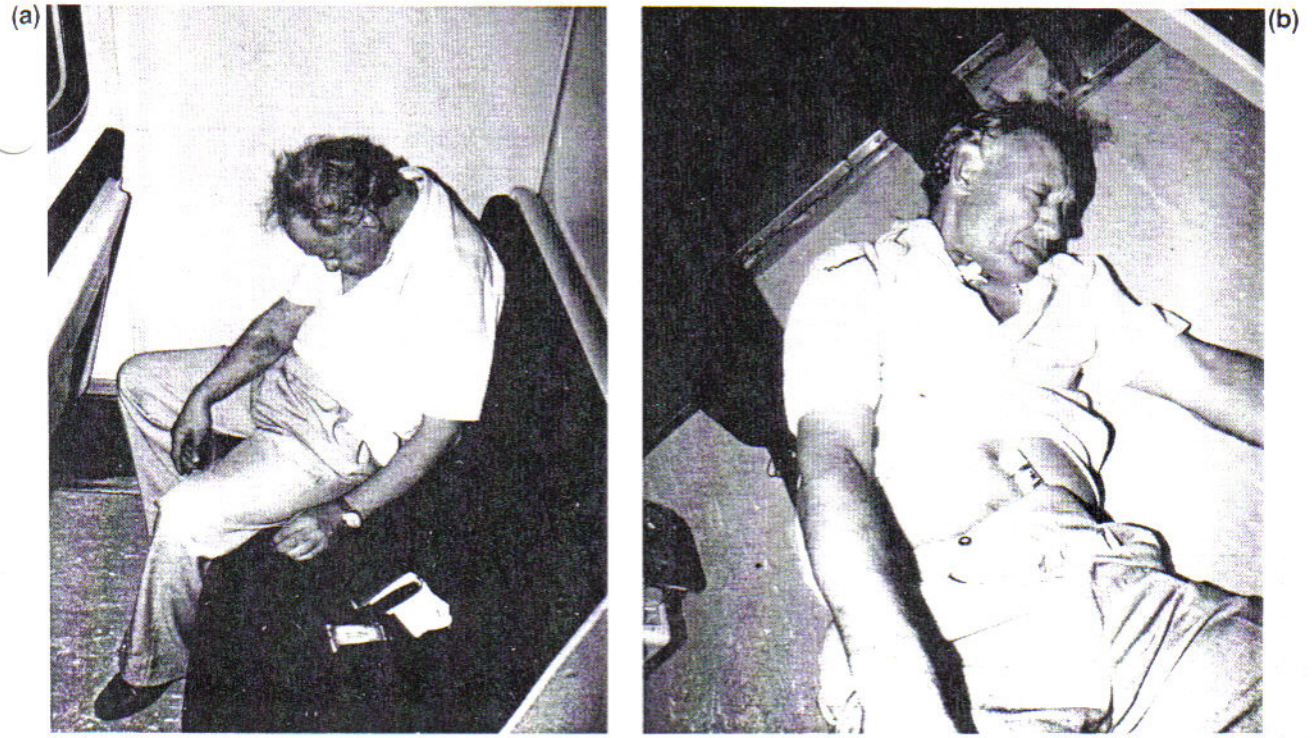

FIG. 5. (a) This 47-year-old commuter train rider was found dead sitting upright with his head flexed. **(b)** Closer inspection revealed the occluded tracheostomy tube and a pint of vodka protruding from his pants. His postmortem ethanol level was 0.40%.

FIG. 6. This 40-year-old woman was discovered dead sitting next to her bed with her head flexed. She had a nontoxic goiter and a postmortem ethanol concentration of 0.29%.

FIG. 7. This 37-year-old alcoholic was discovered in this awkward position with her legs tucked under her stomach. Note the whisky bottle near her left foot.

FIG. 8. This 77-year-old alcoholic was found lying over his bathtub, thus severely restricting both diaphragm and chest wall movement. His postmortem ethanol concentration was 0.21%.

be the result of continued metabolism while they were asleep with a partial airway obstruction. This underscores the importance of scene observation and, particularly, notations and photographs of the exact body position when it was found (which is not necessarily what the police or forensic investigators observed).

The two deaths of positional asphyxiation involving demented patients with vest restraints are similar to those reported by Dube and Mitchell and others (12, 13) and again emphasizes that this apparel can be deadly. One of our victims rolled down a stairway while restrained in her wheelchair, coming to rest in the unnatural position that caused her death (Fig. 9).

In summary, sudden death of the alcoholic is commonly found by medical examiners. The cause of death is often chronic alcoholism and the mechanism is often unknown or ascribed to fatty liver (14), delirium tremens, and other maladies (15). This is especially true if the autopsy fails to disclose any "significant" pathologic abnormalities. The 30 cases of positional asphyxiation reviewed here might have gone undetected if the details of the death scene had not been known to the pathologist. Scene photographs of the undisturbed decedent were extremely helpful and, in some cases, essential. Pulmonary edema and, occasionally, skin, conjunctival, or visceral petechiae in the nonresuscitated victim are clues for an asphyxial mechanism of death and should prompt a thorough evaluation of the death scene. Positional asphyxia as a cause of death should not be overlooked in the alcoholic who dies suddenly, has a "negative" autopsy, and variable

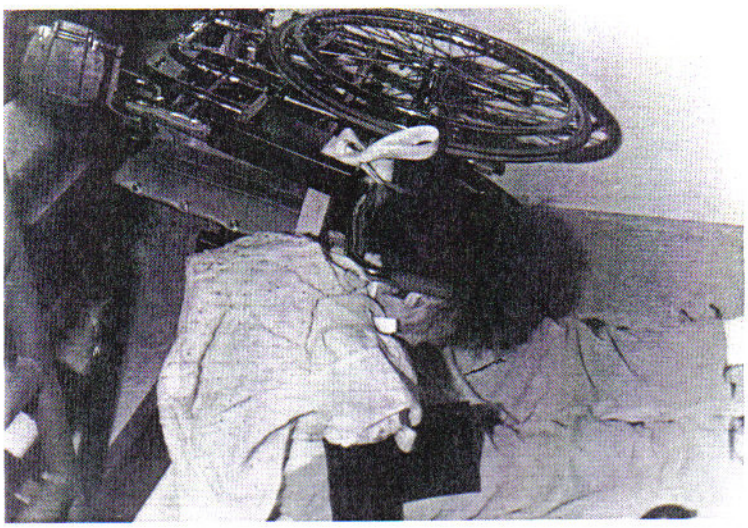

FIG. 9. This 79-year-old demented patient eluded her caretakers only to become trapped in her restraint vest and wheelchair after she fell down a flight of stairs.

ometimes low) levels of drugs and alcohol de-
cted in the blood and urine. □

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